Study on The Improvement of Cycle Life of $Li_{3-x}Co_xN$ as An Anode of Li-Ion Secondary Battery

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Abstract

Graphite has been widely used as the anode material of commercial Li-ion secondary battery. With the growing demands of high capacity secondary battery, the low capacity of graphite (theoretical capacity: 372 mAh/g) has been thought to be the limiting factor in wide applications and a new anode material with high capacity has been sought for. Of many materials, $Li_{2.6}Co_{0.4}N$ showed the best anode performance. It showed very high capacity of 1024mAh/g, good rate capability (1C/0.2C = 94.94%) and extraordinary initial Coulometric efficiency (96%). In addition to the excellent capacity of this material, its rate capability was much superior to that of graphite (82～88%). However, it cannot be commercialized because its capacity loss after 30 cycles is around 40%. As a result of various analyses, it was confirmed that the formation of CoF_2 film caused by the decomposition reaction between electrolyte and $Li_{2.6}Co_{0.4}N$ is the main reason of its cyclic degradation. As a method to improve the cyclic degradation, iron doping in $Li_{2.6}Co_{0.4}N$ was suggested and attempted to restrain the formation of CoF_2 film on the surface of $Li_{2.6}Co_{0.4}N$. $Li_{2.6}Co_{0.35}Fe_{0.05}N$ had a little lower capacity (about 900mAh/g) than $Li_{2.6}Co_{0.4}N$ (1024mAh/g), but showed much better cycle life than $Li_{2.6}Co_{0.4}N$ (35%→60% after 50 cycles).

Reference

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